Limited-Stop Bus Service at New York City Transit

Introduction

Improving the speed and reliability of high volume urban bus service is an important transit planning objective. One means of increasing travel speed is to provide a limited-stop bus service component on heavily patronized local bus routes. This paper explores the characteristics of limited-stop bus service and the experience of MTA New York City Transit with this type of service. It also describes the key issues, factors, and customer response associated with this service strategy.

Definition of Limited-Stop Service

In general, limited-stop bus service is a variant of local bus service that makes stops at 8 to 10-block (1/2-mile) intervals, usually at major intersections, institutions (hospitals, museums, etc.), or stops that for other reasons have particularly high numbers of boardings and alightings. In contrast, local bus service makes stops every two to three blocks (every 500-750 feet). Limited-stop service, which makes regularly placed stops throughout the entire length of a route, also is different from zone-express service. Zone-express service offers local service in one portion of a route and then operates express, with one (or a few) stops at the other end of its route.

In general, limited-stop service falls into two categories; either a feeder route, where a route has a terminal that is a transportation hub or other type of high-volume trip generator, or a grid route, where the route has multiple significant trip generators at which customers board or disembark. In the case of both grid routes and feeder routes, limited-stop service is usually superimposed upon, or created in combination with an existing high volume local service.

Overview of Limited-Stop Service in New York City

New York City Transit began operating its first limited-stop bus service 25 years ago in Manhattan to address customer complaints about slow bus travel speed due to increasing street traffic, and the emergence of van/taxicab competition. Limited-stop service, because it made fewer stops, was less subject to the unpredictability of traffic congestion, creating an opportunity for more efficient scheduling and less running time variability (i. e. enhanced reliability). It also offered customers an effective alternative to van/taxicab competition. By the late 1980's, limited-stop bus service had increased its presence dramatically, with routes operating in all five boroughs (counties) that compose New York City.

There are now approximately 200 local bus routes in New York City, of which 28 have a limited-stop component. Of these 28 limited-stop services in New York City, 16 operate only during peak hours. The routes range from those on corridors in dense urban areas to those on less densely populated corridors with more suburban characteristics. Table 1 provides the specific operating characteristics of each route.

To date, limited-stop service has been considered extremely beneficial for New York City Transit and its customers. As limited-stop service continues to expand, it is worthwhile to assess the factors that have contributed to its success and to consider some of the issues that still are being addressed as limited-stop service continues to evolve.

Characteristics of Limited-Stop Service

Certain factors contribute to the effective implementation of limited-stop service. In general, these involve elements of time and geography. They also relate to passenger volume, customer travel patterns, coordination with local service and other competing and complementary modes, as well as costs versus revenues.

With regard to geography, limited-stop bus routes operate most effectively when certain criteria are observed:

- limited-stop service should operate on wider roadways, those operating at level of Traffic Level of Service "C" or better;
- limited-stop service should operate on roadways, where possible, with progressive signaling;
- limited-stop service should operate with approximately 1/2-mile spacing between bus stops;
- limited-stop service should not operate closely parallel to rapid transit or commuter rail routes since these already offer an easily-accessible, faster alternative;
- origin-destination data should indicate a large market component for longer distance trips.

The combination of each of these factors allows limited-stop buses the opportunity to maneuver from the curbside or right traffic lane in which they regularly are halted by turning traffic, double-parked vehicles, and local buses, into the free-flowing travel lane where they can proceed more quickly for a reasonable distance. As an example, on the east side of Manhattan, a Third Avenue limited-stop bus (M101) saves five minutes compared with a local-stop bus by avoiding a queue of traffic turning onto the Queensboro Bridge. Once in the freer flowing traffic lane, additional speed is obtained because bus operators on limited-stop trips do not need to be prepared to stop at each local stop.

Regarding the proximity of rapid transit or commuter rail lines, there are cases in New York City where it does make sense to allow limited-stop service to operate close by these faster options. These cases however, are unique and very particular to their locations. For example,

well patronized limited-stop bus service on Routes M101 and M98 operates directly above the Lexington Avenue Subway Line served by Routes # 4, #5 and #6 in Manhattan; and bus Routes Bx1 and Bx2 operate over the Concourse Subway Line served by Route D in the Bronx. Their effectiveness reflects the fact that some customers, particularly senior citizens, no matter the circumstances, feel more comfortable on buses. In the case of the Lexington Avenue subway, there are also capacity limitations at certain hours. With respect to the Concourse subway, the extreme dimensions of the mezzanines, combined with their distance from street level, present a disincentive to shorter intraborough trips.

The length of a route is also relevant. Currently, routes that have limited-stop service range in length from 5.1 miles to 11.0 miles and average 8.3 miles for the entire city. By borough, Manhattan has the longest limited-stop routes, averaging 9.9 miles, and Queens has the shortest routes, averaging 6.8 miles. New York City Transit has not developed a formal policy regarding eligibility of a route for limited-stop service based on route length.

The length of the limited-stop service segment, when it is compared to local service on the same route, is another issue. Because limited-stop trips travel faster, it is more efficient to have limited-stop routes operate for longer distances. Consequently, in New York City, as in other cities, a limited-stop component often will extend farther at the outer ends than its local counterpart. In these instances, the local service provides “short-turn” service to meet high customer volume on the inner segment of the route.

Customers who travel between the outer end of a route and a local stop in the center of the corridor, where both local and limited-stop service is available, may need to transfer between the limited and local service, or walk to the closest stop for limited-stop service. Examples of these complementary services are Route S61/S91 on Staten Island (on Staten Island, the limited-stop variant of a local service has a 90-series route number), Route B44 in Brooklyn, Route Bx12 in the Bronx, and Route Q46 in Queens. In these instances, the limited-stop route operates as a local service on the extremities of the corridor where the local service is not in operation. This is an effective method for increasing efficiency.

Some market characteristics become apparent when considering the differences between grid and feeder routes. In general, feeder routes that offer limited-stop service tend to be located in eastern Queens and Staten Island, areas of lower density, and have some characteristics more in common with suburban areas. Feeder routes are designed to bring customers to another larger volume mode of service, such as the various rapid transit corridors in Queens, or the ferry on Staten Island. For example, bus Route Q5, which operates on Merrick Road, is a feeder route to and from the E, J and Z (Jamaica Center) subway services in Queens, and Route S94, which operates on Richmond Avenue to the Staten Island Ferry in St. George.

Grid routes that offer limited-stop service are generally located in Manhattan, the Bronx and Brooklyn. These boroughs, particularly Manhattan, have a high population density. Thus, the two types of services operate somewhat differently, but are also are good surrogates for

representing different types of urban areas. On average, feeder routes are 7.4 miles in length as opposed to grid routes, which are on average 9.2 miles in length. Additionally, feeder routes tend to operate at faster speeds. On feeder routes, local service averages 11.3 MPH and limited-stop service is approximately 12.9 MPH. On grid routes, in contrast, local service operates at approximately 7.2 MPH, limited-stop service at operates at approximately 8.7 MPH.

Experience in Other Cities

New York is not the only city to benefit from limited-stop service. Many other cities in North America also have embraced this service. One city that has put them to particularly good use is Los Angeles (LAC/MTA) where 14 limited-stop services are operated out of a total of 164 bus routes. In fact, in Los Angeles, the criteria and methods for employing limited-stop service are very similar to those of New York City Transit. They have found them particularly effective on high-frequency/high-capacity corridors such as Wilshire Boulevard. Other cities in which limited-stop service can be found include Denver, San Francisco, Miami, Pittsburgh, and Chicago. Most recently, in the suburbs east of New York City, Long Island Bus, implemented peak period bi-directional limited-stop service on its highest volume subway feeder route. In a few instances, limited-stop service is complemented with other features, such as bus lanes or contra-flow lanes, to maximize the speed of service.

Like New York, many limited-stop services started appearing in other cities in the 1960's and 1970's, but became much more of a presence in the 1980's. Officials from properties in these cities have generally responded enthusiastically about this type of service, but caution that it must be used with discretion, generally on routes with high enough frequency to offer adequate levels of both local and limited-stop service.

Customer Response

Market research conducted by New York City Transit indicates that customers in New York City have responded very positively to limited-stop service. The faster trip that limited-stop service offers has increased customer satisfaction on the routes where it has been introduced. Some customers, however, object to having an extra walk at either one or both ends of their bus trip. In general though, customers who board at local bus stops have expressed favorable impressions of limited-stop service. While this has not proven an effective method for increasing revenue, in most instances, limited-stop service has led to significantly greater market retention in the corridor where it exists than that for the system as a whole. That is an impressive outcome since NYCT system-wide bus ridership had been in a 20-year long decline until the advent of free intermodal fares in July 1997. With the reversal in this trend

after July 1997 due to the establishment of intermodal transfers and other fare initiatives, limited-stop service has been an effective tool in more efficiently serving this demand growth. This is due to the faster travel time and resultant lower vehicle and operator requirements associated with the faster limited-stop service.

While limited-stop service is certainly faster than local service, customers' perception is of even faster service. Market research has shown customer perception of limited-stop service as double the actual time savings. Indeed, it is not uncommon for customers to pass up local (all-stop) buses in favor of waiting for a limited-stop bus, despite the fact that in some instances, the savings in travel speed will prove to be less than the increased waiting time. The average travel speed is 9.2 MPH for local service and 10.7 MPH for limited-stop service in New York City. It should be noted however, that these average speeds are only for those routes that have limited-stop service. Thus the speeds of cross-town routes, and other routes that operate more slowly, were not part of the calculation of average speed for local service since they would not be candidates for limited-stop service. If all local New York City bus routes were included, the average local bus travel speed would have been slower. This helps account for the highly favorable customer perception associated with limited-stop service.

The M15 bus route, which operates on First and Second Avenues in Manhattan, is a good case study of customers' preference for limited-stop service. An evaluation of travel patterns among customers who used this route determined that the farther customers were traveling, the greater the desire for limited-stop service. This follows since the longer their trip, the greater the time savings a customer would experience. Thus, the difference between the average number of customers on a limited-stop bus at the outer end of the M15 route was disproportionately greater than at stops as the limited-stop bus approached the Midtown CBD area during the morning peak hours. In the evening, this was reversed. For example, during the morning peak period, at Second Avenue at 42nd Street, a stop in the CBD, there were an average of 23 customers on the local bus and 24 customers on the limited-stop bus. There were 73 local bus trips and 59 limited-stop bus trips that were in operation through this stop. In contrast, at Second Avenue at 86th Street, an outer stop, there were 21 customers on the local service and 30 customers on the limited-stop service during the morning in the peak direction. This 48% difference in ridership between the two types of service becomes even more dramatic when considering that of the 152 bus trips that were made during the morning peak period, only 52 trips operate in limited-stop service. (Note that neither of these stops are the maximum load point.)

Effectiveness of Limited-Stop Service

Table 2 gives the average speeds for the 28 limited-stop services and their corresponding local bus elements. While the average speed of local service for each borough ranges from 8.0 MPH

Effectiveness of Limited-Stop Service (Cont'd)

in Manhattan to 14.2 MPH in Staten Island, the associated increase in speed for limited-stop service in each borough is an inverse of the local speed. Thus, there is an average 27% increase in speed from local to limited-stop routes in Manhattan where buses are operating most slowly, as opposed to a 13.6% increase in speed from local to limited-stop service on Staten Island where buses are operating the fastest. Part of this difference may reflect the nature of boardings and alightings in each of the boroughs. In Manhattan, almost every limited-service stop location has customers both getting on and getting off the bus. On Staten Island and in southeast Queens, because most buses are feeder routes, in one direction customers are getting on the bus, with practically no one disembarking, and in the other direction, customers are getting off. Thus, dwell times at bus stops were already much shorter on Staten Island and in Queens. Eliminating stops in these areas had less of an impact on time savings.

Data reflecting financial measures are often a good gauge of the effectiveness of a service. As is the case reported by other transit properties, at New York City Transit, it is less the case that limited-stop service will increase revenue than that it will enhance customers' perception of bus service, and consequently retain customers. This was important in a system with a 20-year history of ridership decline. In addition, for routes where ridership growth and travel patterns indicate a need for increased service, limited-stop service offers the opportunity to limit cost increases. This has become very important in dealing with the more recent ridership increases associated with system-wide fare initiatives.

It should be noted that to separate meaningfully limited-stop from local revenue has been a historically difficult undertaking at New York City Transit. With the advent of new fare collection technology, New York City Transit is better equipped to discern revenue patterns of limited-stop service compared with local service. Note that any analysis of revenue based on limited-stop versus local service should be geared not just to a comparison between the two types of service on a route, but to that on the corridor as a whole.

The counterpart to revenue is operating cost. The difference in speed between local and limited-stop buses is a worthwhile surrogate for cost savings. The differences suggest that as much as 27% of costs are saved in Manhattan by converting a local trip to a limited-stop trip. Using this method, the average savings for all routes in the city that are eligible for incorporating a local trip to a limited-stop service, suggests a theoretical savings of 16% for converting a trip to limited-stop operation. It should be noted that there are many routes, such as cross-town routes that must stop at every intersection, where the introduction of limited-stop service would not be effective. In addition, there are fleet-size economies. A limited-stop service that can save the amount of time that is equal to or greater than the headway of the local service, can create a savings of one peak period bus. For example, if a limited-service saves eight minutes, and the headway is five minutes, a peak vehicle savings is achieved.

Limited-Stop Scheduling

There are a variety of travel time aspects that need to be addressed. Since providing limited-stop service divides the market of riders on a route into at least two separate components, the passenger volume on the overall route should be high enough to support a minimum 5-minute combined headway. In terms of service design guidelines employed by NYCT, this translates into a minimum 10-minute headway on each type of service, limited-stop and local. Except for extraordinary conditions, limited-stop service should not represent more than 50% of the service on a grid route corridor, or 70% on a feeder route corridor. This threshold may not apply to smaller transit properties where lower frequency minimums may be acceptable to achieve noteworthy running time savings.

It is important to consider the ratio of local to limited-stop service, in each corridor where limited-stop service is present, and to consider the proportion of local to limited-stop service on a particular route. The ratio of limited-stop to local service becomes particularly relevant where different routes converge in a corridor segment. For example, concern about adequate local service frequency would not be as great in introducing a limited-stop service where there are a few different local services in operation since their combined frequency should be more than sufficient. However, in the case of a street where there is one route in operation, the chance of sufficiently frequent local service is more likely to be of a concern.

In general, the greater the number of routes in a corridor, the easier it is to assure a marketable local headway. In one instance in Manhattan, however, two of the three routes on a corridor segment (Fifth Avenue south of 34th Street) operate as limited-stop service. Despite the great wealth of service on the corridor, there is an under-representation of local service because two of the local routes diverge from the corridor. As a result, there is currently a proposal that has been considered to reroute one local route, the M1, so that it will continue on Fifth Avenue, increasing the availability of local service.

In Queens, along the Hillside Avenue feeder bus corridor, all Q43 service operates as limited-stop service during the peak period in the peak direction in the middle segment of the route. This is feasible because there is sufficient local bus service along the corridor provided by other routes.

A related, and very significant issue, involves coordinating the scheduling of limited-stop and local service. How can the two types of operation best be scheduled to provide evenly-spaced service for customers? There are a few alternatives for scheduling limited-stop and local service. It is possible to space each service so that their combined headways are even at the maximum load point, at the point of arrivals, or at the point of departures. It is also possible to consider them as entirely separate services, and schedule them without considering their combined headways. Depending on which method is chosen, there will be both services coinciding at some point along their route (i.e. a limited-stop bus will pass a local bus). This, in turn, will yield a longer wait time until the next bus arrives.

The question often becomes how much should each type of service for the same route be considered its own service and how much should the two be considered as parts of the same entity? To an extent, this depends on the amount of limited-stop service available on a particular route. The issue of marketability is key. In a case where there are only a few limited-stop trips in the peak direction, it may be more effective to integrate them into the local service schedule. Conversely, where limited-stop service has more of a presence, no single method is considered superior to others in terms of scheduling limited-stop service. It may make sense to consider each corridor separately rather than to maintain a system policy.

Time Span of Limited-Stop Service

The time span of limited-stop service is also an important consideration. Services that have a significant component of the route or corridor that can operate as limited-stop services make the most sense. In contrast, a very short span of limited-stop service, such as that of the M1, which currently operates southbound in Manhattan on weekday mornings from 7:15 a.m. to 8:15 a.m., can be very confusing to customers since there is no easily recognizable, marketable service pattern.

When limited-stop service was initially introduced in Manhattan, there were four routes (M1, M4, M5, and M10) that each had fewer than six limited-stop trips or departures during each peak period. Unfortunately, ridership and resultant service levels on these routes did not improve. This was primarily because the provision of a very minimal level of limited-stop service along these corridors disrupted the even frequency of local service and did not provide a sufficiently attractive limited-stop service element. Consequently, customers found limited-stop service an unattractive addition to the normal service pattern since it diminished the level of local service and was confusing. For example, in Manhattan, the M5 was changed from being primarily a local route with a few limited-stop bus trips during the two peak periods, to operating exclusively as a limited-stop service during both peak periods and middays. In contrast, another route in Manhattan, the M10, which also formerly had a few limited-stop bus trips during the two peak periods, was changed so that all service on the route operated local. In this case, providing exclusively local service made sense since the presence of sporadic limited-stop service created a confusing service pattern, and rapid transit service (Routes A, B, C, D) operated directly below this bus route, offering a fast alternative.

The recent implementation of Limited-stop service on Route Q44 is an interesting case study whose evolution transcended the NYCT historical decline in bus ridership and the more recent ridership increase due to due to fare initiatives. When the original limited-stop service had been considered, it was planned to be implemented with only as a weekday, peak period, bi-directional component. However, during the more than two years of development of the plan, the ridership profile and volume on the route changed to such a degree (it is now the highest volume bus route in Queens), that all day, 7-day a week limited-stop service was justified

based upon frequency increases in the former all-local service needed to support the growth in usage.

There are currently four broad categories of limited-stop service available on weekdays. These include (in order of ascending level of limited-stop commitment):

- peak periods; peak direction only;
- peak periods; bi-directional service;
- peak periods and middays; bi-directional service;
- peak periods, middays and evenings; bi-directional service.

There are approximately 200 local bus routes in New York City. Of the 28 limited-stop routes in New York City, 16 routes operate only during peak hours with 11 of these routes operating in the peak direction only. There are 9 routes that operate on Saturdays, and 5 of those routes operate on Sundays as well.

It is New York City Transit's intention to continue to expand the span and geographic coverage of limited-stop service on those routes where the combination of service volume and longer distance travel needs support a marketable level of limited-stop and local service.
The relationship between the time spans of local to limited-stop bus service is somewhat complicated by different types of demand depending on time of day. Customers traveling in peak periods tend to be more time-sensitive. Those traveling in the midday are somewhat less time sensitive and more likely to be senior citizens or parents with small children. These people are usually in less of a hurry and also less mobile. Consequently, additional walking distance at either one or both ends of their trip may be more adversely perceived by customers.
This needs to be considered specifically for each situation and weighed against the travel characteristics and volumes of the particular route.

Another characteristic that illustrates the emergence and demand for different spans of limited-stop service is the increase in car traffic in New York City. According to a report entitled *Impact of Congestion on New York Bus Service*, prepared by the Institute for Transportation Systems, buses operate at 59% of the speed of cars when they are both at maximum speed. In traffic congestion however, buses operate at 42% of the speed of cars. Consequently, traffic affects bus speed more severely than it does that of cars.

A corollary to this is the varying nature of traffic in different areas of the city. In the outer boroughs, traffic congestion is a function of the peak periods of travel in the morning and evening when people are traveling to or from work. In Manhattan, in contrast, traffic is also a function of commerce, which is more uniformly spread throughout the day. Consequently, it makes sense to offer primarily peak period limited-stop service in Brooklyn, the Bronx, Queens and Staten Island, and more all-day service in Manhattan.

Marketing

Communication about limited-stop service is essential to its success. It is much easier to market a service plan that is consistent for the entire day than one that varies from one time period to the next. For example, when a route in Manhattan (M5) was being considered for limited-stop service, there were certain ridership characteristics that made it appear desirable to operate as a local service during the midday time period. However, the associated issues of marketability and communication of such a service pattern on a high-volume grid route were also considered. Communicating the time at a particular bus stop that local service would once again be available after the morning rush hour or would stop being available at the start of the evening rush hour, would be extremely difficult. Therefore, it made sense to maintain the same service pattern for the entire day. Los Angeles, which has limited-stop service on most routes only during peak hours, has dealt with this situation by offering alternating local and limited-stop buses. When a customer sees a second local bus in a row, he or she knows that limited-stop service is no longer available.

As limited-stop service has become a common element of the New York City Transit bus system, various visual features have been included on buses, at bus stops, and wherever else possible, to make the service more easily recognizable and easier to use. They include the following:

- Destination signs that indicate that a bus is operating as limited-stop service.
- Window cards in fluorescent colors (orange and purple) saying “Limited” placed on the dashboard.
- Bus stops with special orange and purple “limited-stop” decals (old-look signs).Bus stops which use an information panel of differing color for local and limited-stop services (new look signs).
- Separate limited-stop schedules where schedules are shown at bus stops
- Bus maps that show schedule information separately describe the span and frequency of limited-stop and local service.
- Identification of limited-stop trips on passenger timetables.

Areas for Further Study:

As limited-stop service continues to evolve, there are many issues that must be addressed to optimize its effectiveness. Particular topics that are worthy of further study include:

- The effective analysis of limited-stop revenue compared with local revenue.
- Route length or running time guidelines for limited-stop service.
- Stop-spacing guidelines for limited-stop service.
- Guidelines for establishing the combination or “mix” of local and limited-stop services.

- Guidelines for scheduling to better determine where limited-stop trips should pass local trips.
- The clear communication of service patterns, especially where service alternatives between local and limited are available.

Conclusion:

Based on changing ridership patterns, customer perceptions, traffic conditions, and scheduling efficiency, limited-stop service has been a very effective tool for New York City Transit in offering better service from the perspective of customers and operations. Indeed, over the coming years, New York City Transit expects to increase the presence of limited-stop service, both in terms of the span and frequency of existing limited-stop service, as well as its expansion to routes that currently offer local service only. This expansion however, will be governed by the criteria established to date and those that evolve from areas cited for future study within this report. New York City Transit's experience, reported herein, may prove helpful for other transit agencies contemplating implementation or expansion of limited-stop bus service.

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